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Noise Pollution from Assembly Buildings in Uyo, Nigeria: Case Study of Church Buildings

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Abstract: Church buildings, classified under assembly buildings, are places of regularly visits, mainly for spiritual purposes. But, when church activities give rise to intrusive sounds, such sounds often translate into noise pollution. This study, thus, aimed at assessing levels of noise pollution from churches within Uyo Local Government Area of Akwa Ibom State. The study adopted an experimental design that involved the use of a Sound Level Meter to measure sounds from selected churches and assessment of possible incorporation of acoustic materials in the church buildings. The sound produced in the sampled 162 churches were all higher than the recommended 60 dB during the day and 40 dB in the night, for residential areas and the 75 dB during the day and 50 dB in the night, for commercial areas, as contained in Section 34 of the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007, Part 1 - Permissible Noise Levels, 2(2). Also, only six (6) of the 162 sampled churches had acoustic control systems incorporated in the buildings. The Student's T-test gave a two-tailed p-value of 0.000 which is lower than the alpha value of 0.05, indicating that the sample mean of 110.929 (± 7.8307) statistically differed from the hypothesized mean (85). It is recommended that Governments at all levels should regularly sensitize the public on the noise control provisions and enforce the Act appropriately.

Key terms: Sound Control, Noise pollution, Acoustics, Assembly buildings, Churches.

1.0 Introduction

Sound Control in assembly buildings entails proper building construction and implementation of appropriate acoustic measures to stop external sounds from entering assembly buildings and internal sounds from leaving the assembly buildings. Lack of proper sound control systems in assembly buildings is a nuisance to the environment. This is a major problem in Akwa Ibom State, where four to five churches are, in some places, located on the same street and no good distance observed between each other. Unlike occupational noise which is predictable, expected and can be overcome with the use of earplugs and other personal protective equipment (Qzar *et al*., 2020), noise from assembly buildings which is non-occupational, is highly unpredictable and could grow very loud, based on the population of the assembly, the choice of musical instruments and electronic sound systems in use.

When sounds generated from assembly buildings become either intrusive or uncontained, they constitute noise pollution. Provisions of the law on the expected levels of sounds from assembly buildings, including places of worship, are clear on the unacceptable levels of noise. Ignorance of the legal provisions and requisite acoustic systems, the intention to publicize the churches and unaffordability of the acoustic systems/materials, are among reasons for non-incorporation of sound absorbing systems in church buildings. Granted that acoustic conditions constitute indicators of comfort levels and affect the well-being of humans (Al-Isawi *et al.*, 2022), this study seeks to measure sounds produced by churches during regular services and assess levels of incorporation of sound control materials in the church buildings.

2.0 Literature Review

Noise, once referred to as the "forgotten pollutant" (King, 2022), is unwanted sound that creates annoyance, interferes in conversations, disturbs sleep, affects learning processes, reduces work efficiency, causes stress and constitutes a great challenge to public health (Debnath, Nath and Barthakur, 2012); or any sound that disrupts the natural rhythm of life or degrades the standard of life (Sahana & Karthigayini, 2020). According to Morano *et al.* (2021), noise contrast with sound in that sound emission becomes noise when it compromises quality of life and negatively impacts on the environment. The level of noise in an area portrays the environmental quality of that area and affects the rental value of properties in the area (Morano *et al*., 2021). The effects of noise have been broadly discussed by several authors that considered the impacts of noise pollution on humans as multi-dimensional and complex (Omubo-Pepple, Briggs-Kamara & Tamunobereton-ari, 2010; Anomohanran, 2013; European Commission, 2015; Marusceac and Ciotlaus, 2018; Oguntunde, Okagbue, Oguntunde and Odetunmibi, 2019; Adekunle, *et al.*, 2021; Jain, 2021).

Today, individuals and governments invest in Assembly buildings like event halls, churches, mosques, among others. Yet, little or no plan is often taken on board to control the potential high-pitched sounds from the assembly buildings. Noise and sound control in assembly buildings can only be achieved by proper building construction and suitable incorporation of sound-

proofing materials (Mahmoud *et al*., 2019). Hence, to provide effective sound insulations in assembly buildings, adequate provisions must be made from the design stage to construction stage.

Researches by Usikalu and Kolawole (2018) and Basheer *et al.*, (2022), classified the impacts of noise into auditory and non-auditory. The auditory effects also known as physical effects or hearing abnormalities (Basheer *et al.*, 2022), constitute general hearing defects. Non-auditory effects are: poor work performance in form of productivity reduction and misinterpretation of what is heard; psychological effects such as stress, sleeplessness, irritability and various disorders; and physiological effects, such as ulcer, irregular heartbeats and increased blood pressure (Usikalu and Kolawole, 2018).

The Government of Nigeria through the Capital City Development Authorities and Town Planning Authorities have demonstrated commitment towards planning and development of the cities and villages; however, the sheer number of churches springing among dwellings and creating serious noise pollution, denote grey areas in the functions of the Authorities. As posited by Akanni (2013), even as the worship centres are very useful and supposed to be relatively close to the worshippers, their distances from each other and to the dwellings, have serious implications for the Planning Authorities.

In Nigeria, noise pollution is mainly addressed through two legal channels, the first being the Common Laws and the second, Policies and Statutes (Ijaiya, 2014). The common laws, often based on judicial antecedents, do not comprehensively address the complexities of noise control and are often very prolonged; thus, the application of policies and statutes (Ijaiya, 2014). The relevant policy on noise pollution in Nigeria is the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act. Sections 28 and 107 of the 2003 National Environment Act, Cap 153, (Noise standards and Control), states that the maximum permissible noise (dB) for places of worship in residential areas should be 60 dB and should not exceed 75 dB for commercial areas for Day. Details of the permissible dB related to places of worship are contained in Table 1. However, in Algeria, the noise thresholds are unified for the various zones as contained in the Algerian executive decree 93-184 of July 27th, 1993, which holds that *"the maximum noise level in urban areas, industrial areas, public places and roads should be 70 dB at morning (6:00 am to 10:00 pm), and 45 dB at evening"* (Arbaoui *et al*., 2018, p1). According to Sahana and Karthigayini (2020), most times, there is lack of delineation among the Residential, Commercial and Social areas of our cities. The idea of a unified noise level for residential, commercial and industrial zones is, however, considered unacceptable in most countries, because it fails to identify acoustic discomfort zones, that is, zones where sound levels and sound pressure levels are expected to exceed the normative values (Stepova, *et al.*, 2022).

Table 1: Maximum Permissible Noise Levels for Places or Areas of Worship

Column 1	Column 2	
Noise Control Zone	**Sound Level dB (A) (Leq) Day**	**Sound Level dB (A) (Leq) Night**
Residential	60	40
Commercial	75	50

Industrial	85	65

Day, 6:00am - 10:00pm; Night, 10:00pm - 6:00am

(Federal Republic of Nigeria, 2009, p. B1315).

Findings of a study conducted by Jain (2021) revealed that normal conversation is about 60 dB, sounds from leaves rustling, soft music, whispers, average 30 dB and sounds from a Boom box range between 96 – 100 dB. Generally, sounds exceeding 85 dB are harmful, depending on the length of exposure and whether hearing protections were used when exposed to such sounds (Jain, 2021). Lower sound levels are required in the Nights, even in industrial zones, because of the ease of transmission to distant places due to the silence of the nights and the negative impacts on people's night sleep (Wang 2019). Table 2 reveals some observed noise levels (in decibels) of common sources of sounds. The decibel which is a unit of sound, is a logarithmic unit and each increase of 10dB is equivalent to a 10-fold increase in sound intensity; thus, a sound of 50dB is 10 times more intense than a sound of 40dB and a 60dB sound is 100 times more intense than the 40dB sound (Abdulkareem, 2018).

Table 2: Some Observed Noise Levels (in decibels) of Common Sources of Sounds

NOISE	AVERAGE DECIBELS (dB)
Leaves rustling, soft music, whisper	30
Average home noise	40
Normal Conversation/background music	60
Office noise, inside car at 60mph	70
Vacuum Cleaner, Average radio	75
Heavy Traffic, window door conditioner, noisy restaurant, power lawn mower	80 -89 (sounds above 85dB are harmful)
Subway, Shouted conversation	90 – 95
Boom box, ATV, motorcycle	96 – 100
School Dance	101 – 105
Chain Saw, leaf blower, snow mobile	106 – 115
Sports Crowd, rock concert, loud symphony	120 – 129
Stock car races	130
Gun Shot, siren at 100 feet	140

(Jain, 2021).

2.1 Aim and Objectives of the Study

This study aimed at assessing levels of noise pollutions from churches in Uyo L. G. A. of Akwa Ibom state, in order to create awareness of how the churches are performing in terms of noise pollution and control. To achieve the above aim the study shall assess the levels of compliance of churches in Uyo L.G.A. to National legislations on Sound and Noise Control, and examine the churches for potential incorporation of sound control mechanisms in the buildings.

2.2 Research Hypotheses

H_0: The mean of the sampled Churches is equal to the hypothesized mean ($\mu = \mu_0$)
H_1: The mean of the sampled Churches is not equal to the hypothesized mean ($\mu \neq \mu_0$)
Where μ is the sample mean and μ_0 is the hypothesized mean.

The hypothesis shall be tested using the Student's T-test. The result of this hypothesis will provide an understanding of how much the mean of the sampled Churches differs from the Government approved level of sound from Churches in Nigeria.

2.3 Area of Study

There are several churches in Uyo L.G.A. of Akwa Ibom State, but to gather comprehensive data on the subject, the areas around the city centre with the highest cluster of churches, and dwellings were chosen for this research. The area which is about 1.2 kilometres around the city centre is indicated in Figure 1, with the blue lines indicating the neighbourhoods under study. The decision to assess the most densely populated areas was informed by the need to evaluate the worst cases of noise pollution from Churches in Uyo Local Government Area.

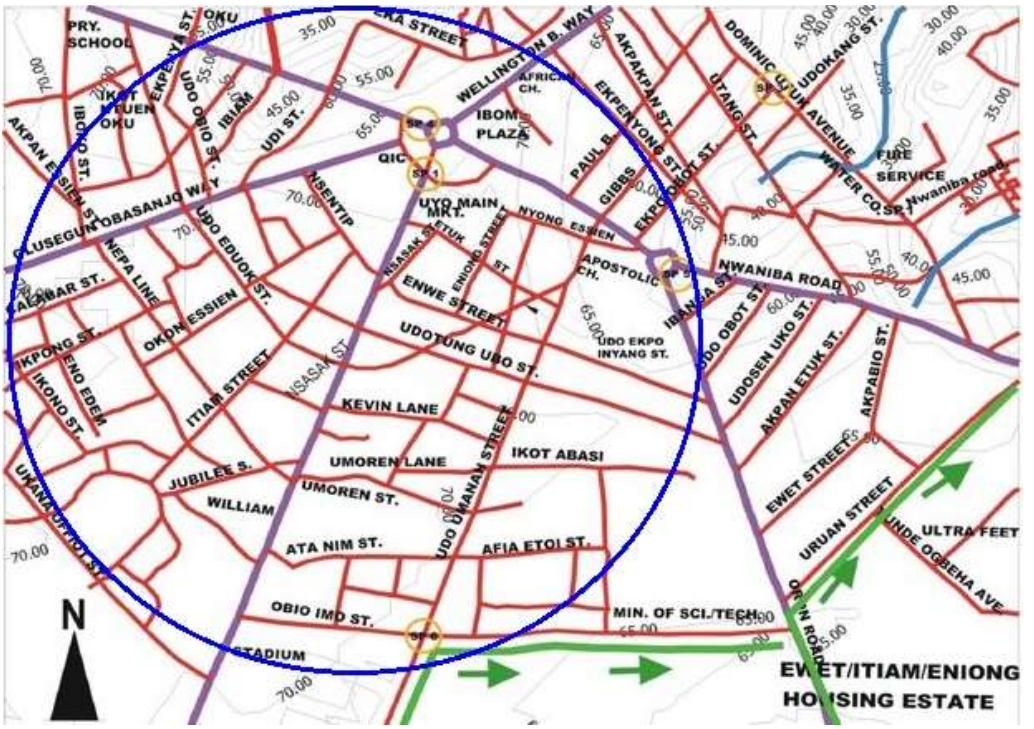

Figure 1: Map of study area
Adapted from Mmom and Essiet (2014)

3.0 Methodology

This study adopted a field experimental design. Data were obtained from both the secondary and primary sources. Secondary sources of data used for this study include textbooks and the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007, Part 1 - Permissible Noise Levels, 2(2), while the primary data sources comprised the field experiments. The field experimental design entailed the use of a Sound Level Meter to measure sounds emitted in decibels from the selected Churches. The SMART SENSOR Mini Digital Sound Level Meter LCD Display, Model AS804 with a measuring Range of 30 - 130dBa and manufactured by Intell Instruments, was used for this

purpose. 162 Churches were purposively sampled due to their locations in the busiest part of Uyo Local Government Area (the city centre). These churches are revealed in Table 3 and constitute the Sample frame for the study. The names of the churches are anonymized on a note of ethics. Thus, in reporting the sounds measured, these churches are randomly designated Church No. 1 – 162 (See Table 3).

4.0 Results and Discussion

4.1 Results of the Sound Measurements

Table 3 reveals the results of the sound measurements (in decibels) carried out in the Churches under investigation.

Table 3: Results of the sound meter measurements in Churches

S/N	CHURCHES	LOCATION	SOUND (dBA)	ACOUSTIC/NO ACOUSTIC	METHOD USED (IF ANY)
1	CHURCH No. 1	Afia Street	90	No Acoustic	-
2	CHURCH No. 2	Udo Street	90	No Acoustic	-
3	CHURCH No. 3	Wellington Bassey Way (Barracks Road)	90	No Acoustic	-
4	CHURCH No. 4	Wellington Bassey Way (Barracks Road)	92.1	No Acoustic	-
5	CHURCH No. 5	Nyong Essien	92.3	No Acoustic	-
6	CHURCH No. 6	Enwe Street	95	No Acoustic	-
7	CHURCH No. 7	Eka Street	98	No Acoustic	-
8	CHURCH No. 8	Utang Street	98	No Acoustic	-
9	CHURCH No. 9	Gibbs Street	98.6	No Acoustic	-
10	CHURCH No. 10	Abak road	99	No Acoustic	
11	CHURCH No. 11	Oron road	99	No Acoustic	-
12	CHURCH No. 12	Udo Ekpo Inyang Street	99	No Acoustic	-
13	CHURCH No. 13	Ennang Uko Street	99.5	No Acoustic	-
14	CHURCH No. 14	Ennang Uko Street	99.5	No Acoustic	-
15	CHURCH No. 15	Gibbs Street	99.5	No Acoustic	-
16	CHURCH No. 16	Etuk Street	99.6	No Acoustic	-

17	CHURCH No. 17	Enwe Street	100	No Acoustic	-
18	CHURCH No. 18	Gibbs Street	100.2	No Acoustic	-
19	CHURCH No. 19	Jubilee School road	100.2	No Acoustic	-
20	CHURCH No. 20	Atim Atakpo Street	100.5	No Acoustic	-
21	CHURCH No. 21	Ebong Street	100.5	No Acoustic	-
22	CHURCH No. 22	Enwe Street	100.5	No Acoustic	-
23	CHURCH No. 23	Enwe Street	100.5	No Acoustic	-
24	CHURCH No. 24	Ibiam Street	100.5	No Acoustic	-
25	CHURCH No. 25	Ikot Ekpene Road	100.5	No Acoustic	-
26	CHURCH No. 26	Oron road	100.8	No Acoustic	-
27	CHURCH No. 27	Atim- Atakpo Street	101	No Acoustic	-
28	CHURCH No. 28	Nepa Line	101.2	No Acoustic	-
29	CHURCH No. 29	Etuk Street	101.4	No Acoustic	-
30	CHURCH No. 30	Nsasak Street	101.4	No Acoustic	-
31	CHURCH No. 31	Etuk Street	102.3	No Acoustic	-
32	CHURCH No. 32	Enwe Street	102.5	No Acoustic	-
33	CHURCH No. 33	Iman Street	102.5	No Acoustic	-
34	CHURCH No. 34	Kelvin Lane	102.5	No Acoustic	-
35	CHURCH No. 35	Kelvin Lane	102.5	No Acoustic	-
36	CHURCH No. 36	Oron road	102.9	No Acoustic	-
37	CHURCH No. 37	Wellington Bassey Way (Barracks Road)	102.9	No Acoustic	-
38	CHURCH No. 38	Ikot Ekpene Road	103.5	No Acoustic	-
39	CHURCH No. 39	Ikot Ekpene Road	104.5	No Acoustic	-
40	CHURCH No. 40	Iman Street	104.5	No Acoustic	-

41	CHURCH No. 41	Kelvin Lane	105	No Acoustic	-
42	CHURCH No. 42	Kelvin Lane	105	No Acoustic	-
43	CHURCH No. 43	Udotung Ubo	105	No Acoustic	-
44	CHURCH No. 44	Utang Street	105	No Acoustic	-
45	CHURCH No. 45	Kelvin Lane	105.1	No Acoustic	-
46	CHURCH No. 46	Ikpa Road	105.2	No Acoustic	-
47	CHURCH No. 47	Nwaniba Road	105.2	No Acoustic	-
48	CHURCH No. 48	Etuk Street	105.3	No Acoustic	-
49	CHURCH No. 49	Ibiam Street	105.5	No Acoustic	-
50	CHURCH No. 50	Udotung Lane	105.5	No Acoustic	-
51	CHURCH No. 51	Kelvin Lane	107	No Acoustic	-
52	CHURCH No. 52	Jubilee School road	107.9	No Acoustic	-
53	CHURCH No. 53	Utang Street	108	No Acoustic	-
54	CHURCH No. 54	Nwaniba Road	108.5	-	Acoustic Curtain all around the walls of the Church and Acoustic Foam over the ceiling.
55	CHURCH No. 55	Abak road	108.9	-	Acoustic Ceiling
56	CHURCH No. 56	Udokang Close	109.3	No Acoustic	-
57	CHURCH No. 57	Ebong Street	109.5	No Acoustic	-
58	CHURCH No. 58	Jubilee School road	109.5	No Acoustic	-
59	CHURCH No. 59	Udo Street	109.5	No Acoustic	-
60	CHURCH No. 60	Oron road	109.8	No Acoustic	-
61	CHURCH No. 61	Ibiam Street	110	No Acoustic	-
62	CHURCH No. 62	Ikpa Road	110	No Acoustic	-

63	CHURCH No. 63	Udo Ekpo Inyang Street	110	-	Acoustic Curtain
64	CHURCH No. 64	Udo Street	110	No Acoustic	-
65	CHURCH No. 65	Ikpa |Road	110.5	No Acoustic	-
66	CHURCH No. 66	Kelvin Lane	110.5	No Acoustic	-
67	CHURCH No. 67	Udo Street	110.5	No Acoustic	-
68	CHURCH No. 68	Ikpa Road	112	No Acoustic	-
69	CHURCH No. 69	Kelvin Lane	112	No Acoustic	-
70	CHURCH No. 70	Nwaniba Road	112	No Acoustic	-
71	CHURCH No. 71	Abak road	112.5	No Acoustic	-
72	CHURCH No. 72	Udo Eduok Street	112.5	No Acoustic	-
73	CHURCH No. 73	Udo Street	112.5	No Acoustic	-
74	CHURCH No. 74	Oron road	112.6	No Acoustic	-
75	CHURCH No. 75	Udokang Close	112.9		-
76	CHURCH No. 76	Imitan Close	113.5		-
77	CHURCH No. 77	Oron road	113.7	No Acoustic	-
78	CHURCH No. 78	Ekpanya Street (Residential Area)	114.5	No Acoustic	-
79	CHURCH No. 79	Etuk Street	114.5	No Acoustic	-
80	CHURCH No. 80	Nsentip Street	114.5	No Acoustic	-
81	CHURCH No. 81	Eka Street	115	No Acoustic	-
82	CHURCH No. 82	Eka Street	115	No Acoustic	-
83	CHURCH No. 83	Ibesikpo Street	115	No Acoustic	-
84	CHURCH No. 84	Ikpa Road	115	No Acoustic	-
85	CHURCH No. 85	Kelvin Lane	115	No Acoustic	-
86	CHURCH No. 86	Nepa Line	115	No Acoustic	-

87	CHURCH No. 87	Nsentip Street	115	No Acoustic	-
88	CHURCH No. 88	Nsit Lane	115	No Acoustic	-
89	CHURCH No. 89	Okon Essien Street	115	No Acoustic	-
90	CHURCH No. 90	Udo Eduok Street	115	No Acoustic	-
91	CHURCH No. 91	Udo Eduok Street	115	No Acoustic	-
92	CHURCH No. 92	Udo Ekpo Inyang Street	115	No Acoustic	-
93	CHURCH No. 93	Udo Ekpo Inyang Street	115	No Acoustic	-
94	CHURCH No. 94	Udo Street	115	No Acoustic	-
95	CHURCH No. 95	Udo Street	115	No Acoustic	-
96	CHURCH No. 96	Udo Street	115	No Acoustic	-
97	CHURCH No. 97	Udotung Ubo	115	No Acoustic	-
98	CHURCH No. 98	Udotung Ubo	115	No Acoustic	-
99	CHURCH No. 99	Udotung Ubo	115	-	Acoustic Curtain
100	CHURCH No. 100	Udotung Ubo	115	No Acoustic	-
101	CHURCH No. 101	Utang Street	115	No Acoustic	-
102	CHURCH No. 102	Ikot Ekpene Road	115.2	No Acoustic	-
103	CHURCH No. 103	Etuk Street	115.4	No Acoustic	-
104	CHURCH No. 104	Abak road	115.5	No Acoustic	-
105	CHURCH No. 105	Atim Atakpo Street	115.5	No Acoustic	-
106	CHURCH No. 106	Enwe Street	115.5	No Acoustic	-
107	CHURCH No. 107	Ibiam Street	115.5	No Acoustic	-
108	CHURCH No. 108	Ikpa Road	115.5	No Acoustic	-
109	CHURCH No. 109	Udotung Ubo	115.5	No Acoustic	-
110	CHURCH No. 110	Utang Street	115.5	No Acoustic	-

111	CHURCH No. 111	Abak road	115.6	No Acoustic	-
112	CHURCH No. 112	Oron road	115.6	No Acoustic	-
113	CHURCH No. 113	Nsasak Street	115.7	No Acoustic	-
114	CHURCH No. 114	Abak road	115.8	No Acoustic	-
115	CHURCH No. 115	Ekpanya Street	115.8	No Acoustic	-
116	CHURCH No. 116	Jubilee School road	115.8	No Acoustic	-
117	CHURCH No. 117	Oron road	115.8	No Acoustic	-
118	CHURCH No. 118	Wellington Bassey Way (Barracks Road)	115.8	No Acoustic	-
119	CHURCH No. 119	Okon Essien Street	116	No Acoustic	-
120	CHURCH No. 120	Eka Street	116.5	No Acoustic	-
121	CHURCH No. 121	Library Lane	116.5	No Acoustic	-
122	CHURCH No. 122	Ekpanya Street	117	Acoustic	Thick Black Material Cloth covered around the back stage of the Church and the windows around the top of the building.
123	CHURCH No. 123	Itiam Close	117	No Acoustic	-
124	CHURCH No. 124	Wellington Bassey Way (Barracks Road)	117.2	No Acoustic	-
125	CHURCH No. 125	Okon Essien Street	117.5	No Acoustic	-
126	CHURCH No. 126	Udo Eduok Street	117.5	No Acoustic	-
127	CHURCH No. 127	Abak road (Commercial Building)	118	Acoustic	Thick Black Material Cloth (Acoustic curtain) covered all around the

				walls of the building.	
128	CHURCH No. 128	Etuk Street	118	No Acoustic	-
129	CHURCH No. 129	Ibiam Street	118	No Acoustic	-
130	CHURCH No. 130	Udo Eduok Street	118	No Acoustic	-
131	CHURCH No. 131	Udotung Lane	118	No Acoustic	-
132	CHURCH No. 132	Utang Street	118	No Acoustic	-
133	CHURCH No. 133	Wellington Bassey Way (Barracks Road)	118	No Acoustic	-
134	CHURCH No. 134	Etuk Street	118.2	No Acoustic	-
135	CHURCH No. 135	Atim Atakpo Street	118.5	No Acoustic	-
136	CHURCH No. 136	Enwe Street	118.5	No Acoustic	-
137	CHURCH No. 137	Enwe Street	118.5	No Acoustic	-
138	CHURCH No. 138	Ibesikpo Street	118.5	No Acoustic	-
139	CHURCH No. 139	Ikot Ekpene Road	118.5	No Acoustic	-
140	CHURCH No. 140	Kelvin Lane	118.5	No Acoustic	-
141	CHURCH No. 141	Wellington Bassey Way (Barracks Road)	118.5	No Acoustic	-
142	CHURCH No. 142	Eka Street	119	No Acoustic	-
143	CHURCH No. 143	Etuk Street	119	No Acoustic	-
144	CHURCH No. 144	Udotung Ubo	119	No Acoustic	-
145	CHURCH No. 145	Wellington Bassey Way (Barracks Road)	119	No Acoustic	-
146	CHURCH No. 146	Wellington Bassey Way (Barracks Road)	119.4	No Acoustic	-
147	CHURCH No. 147	Iman Street	119.5	No Acoustic	-
148	CHURCH No. 148	Nyong Essien Street	119.5	No Acoustic	

149	CHURCH No. 149	Udo Eduok Street	119.5	No Acoustic	-
150	CHURCH No. 150	Udotung Ubo	119.5	No Acoustic	-
151	CHURCH No. 151	Abak road	119.8	No Acoustic	-
152	CHURCH No. 152	Udo Eduok Street	119.8	No Acoustic	-
153	CHURCH No. 153	Oron road	119.9	No Acoustic	-
154	CHURCH No. 154	Udotung Lane	119.9	No Acoustic	-
155	CHURCH No. 155	Nepa Line	120	No Acoustic	-
156	CHURCH No. 156	Abak road	120.2	No Acoustic	-
157	CHURCH No. 157	Eka Street	120.5	No Acoustic	-
158	CHURCH No. 158	Enwe Street	120.5	No Acoustic	-
159	CHURCH No. 159	Nepa Line	120.5	No Acoustic	-
160	CHURCH No. 160	Udotung Lane	120.5	No Acoustic	-
161	CHURCH No. 161	Udotung Lane	121.5	No Acoustic	-
162	CHURCH No. 162	Oron road	125.3	No Acoustic	-

Table 4 reveals the descriptive statistics of the data. It shows that the least measured noise from the churches was 90 dB, while the highest was 125.3 dB. The Sample mean is 110.929 and the deduced standard deviation is 7.8307.

Table 4: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Noise Levels	162	90.0	125.3	110.929	7.8307
Valid N (listwise)	162				

When compared with the provisions of Section 34 of the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007, Part 1 - Permissible Noise Levels, 2(2), which holds that the maximum permissible sound level from places of worship during the day in residential zones shall not exceed 60 dB and 40 dB during the night, and shall not exceed 75 dB during the day and 50 dB during the night, for commercial areas, it

was observed that all the sampled churches generated sounds higher than the 60 dB threshold for residential areas, 75 dB for commercial zones and 85 dB for Industrial areas. Churches Nos. 1, 2 and 3, with an average noise pollution of 90 dB exceeded the 85 dB for industrial areas, with the highest sound pollution being 125.3 dB from Church No. 162, located by the Oron Road of Uyo L. G. A.

Test of hypothesis

Using the data in Table 3, a One-Sample Test was conducted to determine if the sample is from a population with a mean of 85 dB or if the means are statistically significantly different. Results of the test are revealed in Tables 6 and 7.

Table 5: One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Noise Levels	162	110.929	7.8307	.6152

Table 6: One-Sample Test

	Test Value = 85					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Noise Levels	42.145	161	.000	25.9290	24.714	27.144

From Tables 6 and 7, mean noise score of 110.929 dB (± 7.8307 dB) was higher than the hypothesized mean of 85 dB. As the Sig. (2-tailed) or 2-tailed p-value of 0.000 is lower than the alpha value of 0.05, we reject the Null hypothesis (H_0) which states that the mean of the sampled churches is equal to the hypothesized mean ($\mu = \mu_0$), and accept the alternative hypothesis (H_1), which is that the mean of the sampled Churches is not equal to the hypothesized mean ($\mu \neq \mu_0$).

Out of the 162 sampled Churches in the study area, only 6 churches had sound control incorporated in their buildings. This represents 3.7% of the sampled churches.

4.0 Conclusion and Recommendations

From the foregoing, the 162 sampled churches produced sounds that exceeded the maximum permissible sound levels from places of worship during the day in residential zones which is 60 dB and 40 dB during the night, or 75 dB for commercial zones and 85 dB for Industrial areas during the day. A greater number of the churches were located within residential areas. Some of the churches deliberately put out their speakers so the locality could know about them. Also, among the 162 sampled churches, only six had a sound control incorporated in the building to reduce noise pollution during worships. Some of the churches were constructed with temporary

materials that possess little or no capacity to absorb sound. It is recommended that Governments at all levels should regularly sensitize the public on the provisions of Section 34 of the National Environmental Standards and Regulations Enforcement Agency (Establishment) Act 2007, Part 1 - Permissible Noise Levels, 2(2), and enforce the Act appropriately. Accordingly, sound control should be incorporated into the designs and construction of worship centres. Further, given that noise pollution is best controlled at the source of generation itself, noise control signs should be placed at strategic points in and around assembly buildings (Hameed & Sharif, 2022). As posited by Wu *et al.*, (2019), noise mapping or acoustical planning has worked excellently in most cities. This should also be adopted in Nigeria.

References

Abdulkareem, H. (2018). Evaluation of Noise Pollution Indicators in Najaf City. *Kufa Journal of Engineering*, *9*(4), 258-272.

Adekunle, A., Mary, O. O., Tope, A. O., & Caesar, S. M. (2021). Estimation of noise pollution parameters and their health effects on building occupants in Lagos state, Nigeria. *Journal DOI*, *7*(1).

Akanni, A. A. (2013). Location of mosques and town planning laws in Nigeria: Imperatives for integration. *Ilorin Journal of Religious Studies*, *3*(1), 41-68.

Al-Isawi, R., Idan, I. J., & Hassan, A. A. (2022). Investigation of Noise Pollution in an Educational Building–Case Study of Babylon University in Iraq. In *IOP Conference Series: Earth and Environmental Science* (Vol. 961, No. 1, p. 012068). IOP Publishing.

Anomohanran, O. (2013). Evaluation of environmental noise pollution in Abuja, the capital city of Nigeria. *International Journal of Research and Reviews in Applied Sciences*, *14*(2), 470-476.

Arbaoui, I., Hamou, A., Abderrahim, H., Tayeb, A., & Chellali, M. R. (2018). Inter-comparison of noise pollution in Oran (Algeria): urban and industrial areas. *J Mater Environ Sci*, *9*(1), 1-10.

Basheer, T. E., Omar, O. S., & Hashim, S. K. (2022). Effects of Noise Pollution on Zakho University Students at Two Faculty of Science Buildings. *Science Journal of University of Zakho*, *10*(2), 35-38.

Debnath, D., Nath, S. K., & Barthakur, N. K. (2012). Environmental noise pollution in educational institutes of Nagaon Town, Assam, India. *Global Journal of Science Frontier Research Environment & Earth Sciences*, *12*(1), 1-5.

European Commission. (2015). Reviewing the multiple impacts of noise pollution, Science for Environment Policy, Thematic Issue 47, Online: https://ec.europa.eu/environment/integration/research/newsalert/pdf/reviewing_multiple_impacts_of_nois

e_pollution_47si6_en.pdf, Accessed 05 April 2022.

Federal Republic of Nigeria. (2009). National Environmental (Noise Standards and Control) Regulations, 2009; Federal Republic of Nigeria Official Gazette, Online: https://gazettes.africa/archive/ng/2009/ng-government-gazette-dated-2009-10-19-no-67.pdf

Hameed, S., & Sharif, S. (2022). Noise pollution in some hospitals of Erbil-Iraq: estimation and analysis. *International Journal of Mechanical Engineering*, *7*, 2862-2868.

Ijaiya, H. (2014). The legal regime of noise pollution in Nigeria. *Beijing L. Rev.*, *5*, 1.

Jain, S. V. (2021). *Applied Ecology and Sustainable Environment*. BFC Publications.

King, E. A. (2022). Here, There, and Everywhere: How the SDGs Must Include Noise Pollution in Their Development Challenges. *Environment: Science and Policy for Sustainable Development*, *64*(3), 17-32.

Mahmoud, R. M., Abbas, A. H., & Yaseen, R. H. (2019). Assessment of Noise Pollution and Architectural Solutions for The Colleges and Universities. *AUS*, *26*, 445-453.

Marusceac, V., & Ciotlaus, M. (2018). Noise pollution around high traffic zones in Cluj-Napoca. *Acta Technica Napocensis-series: applied mathematics, mechanics, and engineering*, *61*(1).

Morano, P., Tajani, F., Di Liddo, F., & Darò, M. (2021). Economic evaluation of the indoor environmental quality of buildings: The noise pollution effects on housing prices in the city of Bari (Italy). *Buildings*, *11*(5), 213.

Oguntunde, P. E., Okagbue, H. I., Oguntunde, O. A., & Odetunmibi, O. O. (2019). A Study of Noise Pollution Measurements and Possible Effects on Public Health in Ota Metropolis, Nigeria. *Open access Macedonian journal of medical sciences*, *7*(8), 1391–1395. https://doi.org/10.3889/oamjms.2019.234

Omubo-Pepple, V. B., Briggs-Kamara, M. A., & Tamunobereton-ari, I. (2010). Noise pollution in Port Harcourt Metropolis: Sources, effects, and control. *Pacific Journal of Science and Technology*, *11*(2), 592-600.

Qzar, I. A., Azeez, N. M., & Al-Kinany, S. M. (2020). The impact of noise pollution on schools' students of Basra city, Iraq: A Health study. *EurAsian Journal of BioSciences*, *14*, 5197-5201.

Sahana, S., & Karthigayini, S. (2020). Design strategies to reduce the impact of visual and noise pollution in urban areas. *History*, *7*(1), 67-71.

Stepova, O., Kornishyna, A., Lutsenko, I., Kondratov, D., Borysov, A., & Sydorenko, V. (2022). Case study of noise pollution from vehicles and legal mechanisms for road noise

control. *Ecological Questions*, *33*(3), 1-36.

Usikalu, M. R., & Kolawole, O. (2018). Assessment of noise pollution in selected locations in Ota, Nigeria. *International Journal of Mechanical Engineering and Technology*, *9*(9), 1212-1218.

Wang, Z. (2019). Research on Prevention and Control of Environmental Pollution in Building Construction. *Journal of Architectural Research and Development*, *3*(2).

Wu, Q., Zhang, X., & Cao, G. (2019). Study on the prevention and control measures of China's urban road traffic noise pollution. In *E3S web of conferences* (Vol. 96, p. 03003). EDP Sciences.